

IN THE DRAWINGS

The attached sheets of drawings includes changes to Figs. 1, 2, 5, 7, 8, 9, 10, 11, 12, 14, 16, and 17. These sheets, which include Figs. 1, 2, 5, 7, 8, 9, 10, 11, 12, 14, 16, and 17, replace the original sheets including Figs. 1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17.

Attachment: Replacement Sheets

REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 10-24 are currently pending, Claims 10-24 having been added, and Claims 1-9 having been canceled without prejudice or disclaimer. The changes and additions to the claims do not add new matter and are supported by the originally filed specification, for example, by original Claims 1-9 and page 18, lines 7-8.

In the outstanding Office Action, the drawings were objected to; Claims 1 and 3 were objected to for informalities; and Claims 1-9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Tsurumi et al. (U.S. Patent No. 6,334,051, hereafter "Tsurumi") in view of Haapoja et al. (U.S. Pub. No. 2002/0127982, hereafter "Haapoja")

With respect to the objection to the drawings, Applicant submits that the amendments to the drawings, as evidenced by the replacement drawings submitted herewith, overcome this ground of objection.

With respect to the objections to Claims 1 and 3 for informalities, Applicant submits that original Claims 1 and 3 have been canceled, and that new Claims 10-24 do not recite "etc." as was objected to in the Office Action. Therefore, Applicant submits that this ground of objection has been overcome.

With respect to the rejection of original Claim 1 under 35 U.S.C. §103(a), Applicant submits that new Claim 10, which is based on Claim 1, overcomes this ground of rejection. New Claim 10 recites, *inter alia*,

modulating the synthesized-signal amplifier output signal by using the modulating orthogonal signals to generate a pair of intermediate-frequency amplifier output signals that are analog signals and mixing the intermediate-frequency amplifier output signals with locally oscillated two-phase output signals of a second local oscillator which have different phases, to generate desired base-band signals

from which image signals have been canceled, thus demodulating the base-band signals.

Applicant respectfully submits that Tsurumi and Haapoja fail to disclose or suggest at least these features of Claim 10.

Tsurumi is directed to a radio signal frequency receiver. Fig. 1 shows antenna 10, quadrature demodulator 11, quadrature modulator 16, adder 20, and A/D converter 21. With regards to original Claim 1, the Office Action takes the position that the claimed “mixing” occurs in the quadrature modulator 16 and the claimed “summing” occurs in the quadrature modulator 16 at adder 20.

However, the A/D converter is immediately after the adder 20 as shown in Fig. 1 of Tsurumi. Therefore, following the adder 20, the signal will be converted to a digital signal.

Thus, Tsurumi fails to disclose or suggest “modulating the synthesized-signal amplifier output signal by using the modulating orthogonal signals to generate a pair of intermediate-frequency amplifier output signals *that are analog signals*,” as defined by Claim 10.

Applicant also submit that in Tsurumi, at the time of sampling for A/D conversion, extra attention is required to avoid entry of interferential components into the signal by aliasing. In the mixers 17a and 17b in Fig. 1 of Tsurumi, it is impossible to assure the linearity for the signal transmitted from the local oscillator in the current technique. Therefore, it is required to sufficiently damp the frequency components corresponding to the harmonics of the local oscillator 19 in order to avoid the mixture of such frequency components into the harmonics only by means of the filters 15a and 15b. Accordingly, it becomes necessary to take any countermeasure against the occurrence of aliasing in the A/D converter 21 resulted from the signal components created by the mixture of the output signals from the filters 15a and 15b and the harmonics of the output from the local oscillator 19.

Specifically, in Tsurumi, Applicant submits that it is not easy to avoid the occurrence of aliasing.

On the other hand, in a non-limiting embodiment of the invention of Claim 10, analog signals are used in the processing up to the outputs of the multipliers 25a, 25b in Fig. 1 of the present application (see specification at page 18, lines 7-8). Thus, the frequency of the signals 91a and 91b can be set regardless of the sampling frequency in the A/D conversion which will be carried out later, and the sampling frequency in this A/D conversion may be set to low.

Thus, Applicant submits that by using an analog signal in the processing, the problem of aliasing in Tsurumi can be solved. In Tsurumi, there is neither description nor suggestion that the claimed “amplifying” and “modulating,” as defined in Claim 10, may be carried out in the analog signal processing.

Thus, Applicant respectfully submits that Claim 10 (and all associated dependent claims) patentably distinguishes over Tsurumi.

Haapoja has been considered but fails to remedy the deficiencies of Tsurumi with regards to new Claim 10. Thus, Applicant respectfully submits that Claim 10 (and all associated dependent claims) patentably distinguishes over Tsurumi and Haapoja, either alone or in proper combination.

With respect to the rejection of original Claim 3 under 35 U.S.C. §103, Applicant respectfully submits that new Claim 16, which is based on Claim 3, overcomes this ground of rejection. Claim 16 recites, *inter alia*,

modulating the synthesized-signal amplifier output signal by using signals obtained by modulating two-phase output signals of a second local oscillator which have different phases by using the modulating orthogonal signals, to generate a desired base-band signal from which an image signal has been canceled, thus demodulating the base-band signal.

Applicant respectfully submits that Tsurumi and Haapoja fail to disclose or suggest at least these features of Claim 16.

Applicant's Fig. 8 shows a non-limiting embodiment of the features of Claim 16. Fig. 8 shows a modulator 52 which modulates two-phase output signals 92a and 92b of a second local oscillator 13, which have different phases, by using modulating orthogonal signals 91a and 91b from orthogonal signal generator 12. Modulator 52 then outputs modulated signals 93a and 93b.

The Office Action acknowledges that Tsurumi fails to disclose or suggest a second location oscillator for modulating and mixing IF signals to generate the baseband signals from which image signals have been cancelled (see Office Action, at page 5), as was defined in original Claim 3. The Office Action relies on Haapoja to remedy this deficiency of Tsurumi.

Haapoja is directed to a mobile station receiver operable for both single and multi-carrier reception. Fig. 3 of Haapoja shows an image rejection receiver 220 with a signal selection block 220A (see para. [0045]). The Office Action takes the position that the signal selection block 220A corresponds to the claimed "second local oscillator." However, Fig. 3 only shows a single oscillator 260, but does not show selection block 220A having a second local oscillator. Notwithstanding, Haapoja also fails to disclose or suggest "modulating two-phase output signals of a second local oscillator which have different phases by using the modulating orthogonal signals, to generate a desired base-band signal from which an image signal has been canceled," as defined by Claim 16. Thus, although Haapoja shows a structure of an image canceling mixer, this structure is different from the invention defined by Claim 16.

Thus, Applicant respectfully submits that Haapoja fails to remedy the deficiencies of Tsurumi with regard to new Claim 16.

Therefore, Applicant respectfully submits that Claim 16 (and all associated dependent claims) patentably distinguishes over Tsurumi and Haapoja, either alone or in proper combination.

With respect to the rejection of original Claim 7 under 35 U.S.C. §103(a), Applicant respectfully submits that new Claim 22, which is based on Claim 7, overcomes this ground of rejection. Claim 22 recites, *inter alia*,

A direct conversion orthogonal frequency division
multiplexing reception method comprising the steps of:...

based on a result of performing Fourier transform
on the modulated synthesized-signal amplifier output
signal, performing demodulation against the orthogonal
frequency division multiplexing.

Fig. 12 shows a non-limiting example of the features of Claim 22, in which a direct conversion reception method for OFDM (Orthogonal Frequency Division Multiplex) signals is implemented. Normally, to demodulate OFDM signals, a Fast-Fourier Transform (FFT) calculation is carried out for two-phase signals including an I-phase signal and a Q-phase signal as a real part and an imaginary part respectively. On the other hand, in claim 22, the modulated synthesized-signal amplifier output signal, which is a one-phase signal, is submitted to a Fourier transform. For this reason, Applicant submits that, although the amount of needed calculations remains unchanged, only one-phase signal is needed for demodulation and the required hardware is reduced accordingly. Thus, the inconvenience caused by the necessity of matching the gains of phases to each other which would have arisen in the case of two-phase signal is reduced.

However, Haapoja does not utilize OFDM signals, and thus does not disclose or suggest a direct conversion orthogonal frequency division multiplexing reception method, as defined by Claim 22.

Further, Applicant respectfully submits that Haapoja fails to disclose or suggest demodulating OFDM signals by applying a Fourier transform to a one-phase signal. Therefore, Haapoja fails to disclose or suggest “based on a result of performing Fourier transform on the modulated synthesized-signal amplifier output signal, performing demodulation against the orthogonal frequency division multiplexing,” as defined by Claim 22.

Tsurumi has been considered but fails to remedy the deficiencies of Haapoja with regard to Claim 22. Therefore, Applicant respectfully submits that Claim 22 (and all associated dependent claims) patentably distinguishes over Tsurumi and Haapoja, either alone or in proper combination.

With respect to the rejection of original Claim 8 under 35 U.S.C. §103(a), Applicant respectfully submits that new Claim 24, which is based on Claim 8, overcomes this ground of rejection. Claim 24 recites, *inter alia*,

three-valued signals having sequences $\{0, 1, 0, -1\}$
and $\{1, 0, -1, 0\}$ respectively are used as the two
modulating orthogonal signals which are orthogonal to
each other.

The Office Action acknowledges that Haapoja does not explicitly disclose using three-valued signals having sequences $\{0, 1, 0, -1\}$ and $\{1, 0, -1, 0\}$ respectively as the two modulating orthogonal signals which are orthogonal to each other.

The Office Action takes the position that the sequences defined in original Claim 9 (and recited in Claim 24) are obvious “since two signals, i.e., I and Q signals, are different with each other by 90-degree through the center carrier signal; thus, it is obvious that their values are 1, -1, and 0 different and sequence respectively.” (See Office Action, at pages 9-10). However, Applicant respectfully submits that I and Q signals being different with each other by 90-degrees through a center carrier signal is different than describing the exact sequences $\{0, 1, 0, -1\}$ and $\{1, 0, -1, 0\}$, as defined by Claim 24.

Therefore, Applicant respectfully submits that Haapoja fails to disclose or suggest “three-valued signals having sequences $\{0, 1, 0, -1\}$ and $\{1, 0, -1, 0\}$ respectively are used as the two modulating orthogonal signals which are orthogonal to each other,” as defined by Claim 24.

Tsurumi has been considered but fails to remedy the deficiencies of Haapoja with regard to Claim 24.

Therefore, Applicant respectfully submits that Claim 24 patentably distinguishes over Tsurumi and Haapoja, either alone or in proper combination.

With respect to new dependent Claims 13, 15, 19 and 21 (which are based on original Claim 6), each claim recites, *inter alia*,

wherein two-valued signals having sequences $\{1, -1, 1, -1, 1, 1, -1, -1\}$ and $\{1, 1, -1, -1, 1, -1, 1, -1\}$ respectively are used as the two modulating orthogonal signals which are orthogonal to each other.

With regard to original Claim 6, the Office Action took the position that since Tsurumi discloses “two signals are different with each other by 90-degrees, it is obvious that their values are 1 and -1 different and sequency respectively.” (See Office Action, at page 6). However, Applicant submits that the sequences $\{1, -1, 1, -1, 1, 1, -1, -1\}$ and $\{1, 1, -1, -1, 1, 1, -1, -1\}$ are of signals shifted by 1/2 period, and are not of signals whose phases are shifted by 90°, as asserted by the Office Action. That is, they are not of signals shifted by 1/4 period. Therefore, two signals different with each other by 90-degrees is not the same as the sequences $\{1, -1, 1, -1, 1, 1, -1, -1\}$ and $\{1, 1, -1, -1, 1, -1, 1, -1\}$ defined in original Claim 9, and now defined in new Claims 13, 15, 19 and 21.

Thus, Applicant respectfully submits that Tsurumi fails to disclose or suggest the features of dependent Claims 13, 15, 19 and 21.

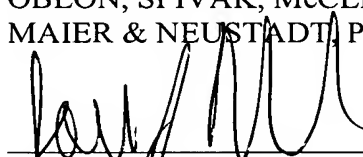
Haapoja has been considered but fails to remedy the deficiencies of Tsurumi with regard to Claims 13, 15, 19 and 21. Therefore, Applicant respectfully submits that Claims

13, 15, 19 and 21 patentably distinguish over Tsurumi and Haapoja, either alone or in proper combination, for at least the foregoing reasons.

Consequently, in light of the above discussion and in view of the present amendment, the outstanding grounds for rejection are believed to have been overcome. The present application is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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